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EDITORIAL COMMENTARY

82-Rubidium—the dawn of cardiac PET in Europe?

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An ever-increasing body of evidence has been published over the last two decades providing the ground based on which nuclear cardiology is now an accepted well-validated, cost-effective non-invasive imaging tool for the diagnostic and prognostic assessment of coronary artery disease. Nevertheless, the number of myocardial perfusion imaging (MPI) studies performed in Europe is low not only compared with the number of MPI performed in the USA, but also from that which would be expected on the basis of epidemiological data. A recent survey on the regulatory background of nuclear cardiology in Europe [1] performed by the European Council of Nuclear Cardiology (ECNC, http://www.ecnc-nuclearcardiology.org/index.php) has pointed out several issues, which may contribute to this situation. In Europe, Nuclear Medicine is a restricted and closely regulated specialty, which on one hand guarantees the quality and safe use of radionuclide. On the other hand, however, it may limit integration of Nuclear Cardiology into the clinical cardiology arena. In fact, cardiologists need to be more involved in nuclear cardiology, otherwise the demonstration that MPI is of clinical value may remain of academic interest. With regards to MPI positron emission tomography (PET) scanning, the situation is even more worrying. Although with the widespread use of oncology PET scanning the availability of scanners has dramatically increased, this has not yet caused a substantial rise in cardiac PET scanning. An ideal flow tracer should be readily available, have a short half-life for repeat rest and stress MPI with negligible waiting time, have a linear extraction rate over a wide range of flow independent of metabolism and deliver low radiation to patient and staff. Although ^{15}O-labelled water may appear closest to such ideal properties, its clinical use is prevented by the fact that it requires high-end post processing as it does not provide clinically useful images. ^{13}N-ammonia is an excellent alternative allowing to obtain images similar to SPECT because this compound is accumulated into myocardial cells by linear extraction over an acceptably wide range of flow. However, both compounds are limited by the fact that they require an on-site cyclotron due to the short half-life of the isotope (9.8 min for ^{13}N; 2 min for ^{15}O).

By contrast, 82-rubidium is a generator-produced tracer, which may meet several requirements of an ideal tracer, including short half-life, short scan time allowing high troughput. Unfortunately, this is also reflected by the short half-life of the generator, which needs to be changed after about 4 to 6 weeks, rendering this technique relatively expensive. In addition, the advantage of a generator, i.e. the fact that there is no need for a cyclotron, is presently often counterbalanced by the fact that satellite PET-centres without cyclotron typically get ^{18}F compounds, mostly fluorodeoxyglucose (FDG), from a distant cyclotron. Thus, for pure logistic reasons the priority so far remained on FDG scanning as FDG has to be used without delay upon delivery, and cardiac scans may be done in the limited remaining slots for example at the end of the FDG program.

In the present issue of the *European Journal of Nuclear Medicine and Molecular Imaging*, Groves et al. have reported on their initial experience using 82-Rubidium

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PET for replacing clinical SPECT myocardial perfusion imaging (MPI) [2]. Image quality was assessed by five nuclear medicine physicians and judged good in 77% and adequate in 23% despite the fact that BMI was over 30 kg/m^2 in 49% of the patients. The diagnostic accuracy was documented by the fact that 93% of the findings were consistent with the coronary angiography, which was however only available in a third of the study population.

The first 82-Rubidium generator has been described in 1981 [3]. The first studies on the clinical utility of 82-Rubidium myocardial perfusion scanning have been reported more than two decades ago [4], but its prognostic value has been fully established only recently [5]. Although 82-Rubidium is now widely used in the US, this tracer has had no commercial success in Europe so far. With this regard, the authors mention in their discussion that 82-Rubidium generator is relatively cheap (in the region of 25,000 Euros), but it is quite clear that such a price can only be called cheap in relation to a very high number of scans. In fact, 82-Rubidium is not only most suited for a high-volume clinical service technically, but its use also economically favours large volume centres as obviously the price of the generator—as opposed to the expensive use of a cyclotron—is independent of the number of the tracer administration.

Every effort should be made by the industry to minimize the price of the generator, so that not only in large Nuclear Cardiology Services—where a PET or PET/computed tomography (CT) scanner can be exclusively dedicated to cardiac scanning—82-Rubidium may finally facilitate a breakthrough of cardiac PET MPI scanning for clinical routine in Europe.

Unfortunately, the present study was restricted to relative flow imaging, although the use of list mode acquisition (not available from the start of the study) would offer the opportunity to calculate flow and flow reserve, which represents one of the big advantages over SPECT. In addition, the authors' approach to use the 16-slice CT only for attenuation correction does not take full advantage of the integrated scanner capabilities, although many readers would have expected new insights into hybrid imaging [6] after reading cardiac PET/CT in the title.

Nevertheless, and although the use of 82-Rubidium has been already described in a number of reports in the literature, the merit of the present study is that it encourages us to benefit from the substantial superiority of PET technique over SPECT, as the transition from SPECT to 82-Rubidium appears easy even from the start, resulting in good image quality even in obese patients. The superiority over SPECT can be expected regarding accuracy, study duration, staff radiation exposure, reduced patient dose, patient discomfort and potentially economic benefit. These are all important implications, which may not have been fully appreciated in Europe so far. The article by Groves et al. may aid awareness of this.

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